Achieving flexible and sustainable energy systems

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Flex4RES

Flexible Nordic Energy Systems

Achieving flexible and sustainable energy systems

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Energy Economics and Regulation

DTU Management Engineering , Denmark

DTU Technical University of Denmark

Nordic Energy Research

DTU Management Engineering

DTU Management Engineering
Institut for Systemer, Produktion og Ledelse

Systems Analysis division

Poul Erik Morthorst

Kenneth Karlsson

- Energy Systems Analysis (ESY)
  - Global and regional energy system optimisation models (all sectors)
  - Integration of intermittent renewables in energy systems
  - GIS prepossessing tools
  - Quantitative scenario analysis

Klaus Skytte

- Energy Economics and Regulation (EER)
  - Analyses of regulatory frameworks and market designs that facilitate the transition towards larger share of renewable energy in the energy system, energy savings, and climate change
  - Policy analysis and economic assessment
  - Economic and social aspects of wind integration, coupling of markets, and flexibility options
  - Demand behaviour based on technical/economic or econometric models

Simon Bolwig

- Climate Change and Sustainable Development
  - Modelling of climate Change mitigation, renewable energy, and smart cities;
  - Decision making tools for climate change impacts and adaptation

Ninette Pilgaard

- Transport Economics

Sister departments

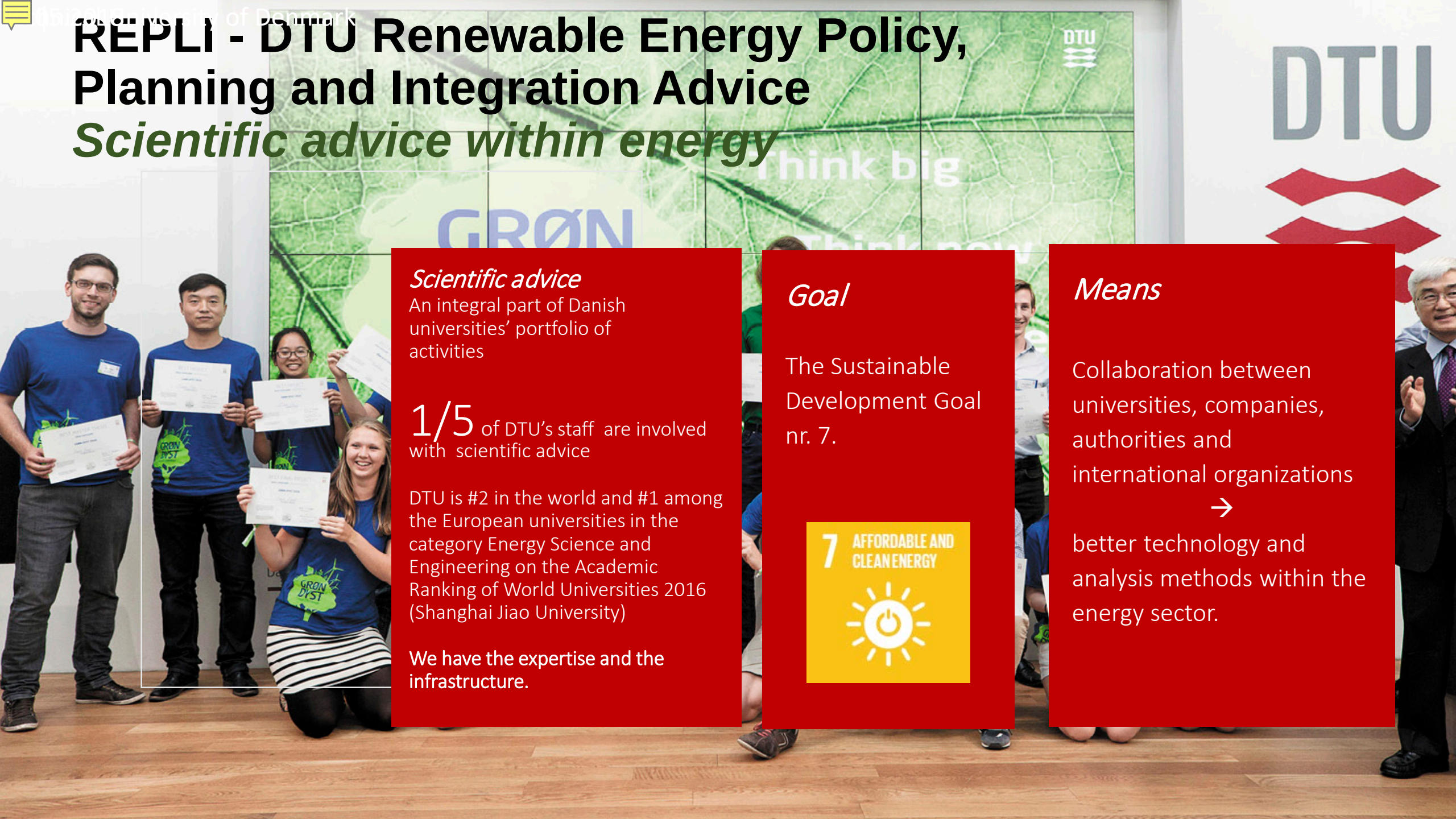
DTU Wind Energy
Department of Wind Energy

DTU Energy
Department of Energy Conversion and Storage

DTU Elektro
Institut for Elektroteknologi

REPLI - DTU Renewable Energy Policy, Planning and Integration Advice

Scientific advice within energy



Scientific advice

An integral part of Danish universities' portfolio of activities

1/5 of DTU's staff are involved with scientific advice

DTU is #2 in the world and #1 among the European universities in the category Energy Science and Engineering on the Academic Ranking of World Universities 2016 (Shanghai Jiao University)

We have the expertise and the infrastructure.

Goal

The Sustainable Development Goal nr. 7.

7 AFFORDABLE AND CLEAN ENERGY

Means

Collaboration between universities, companies, authorities and international organizations

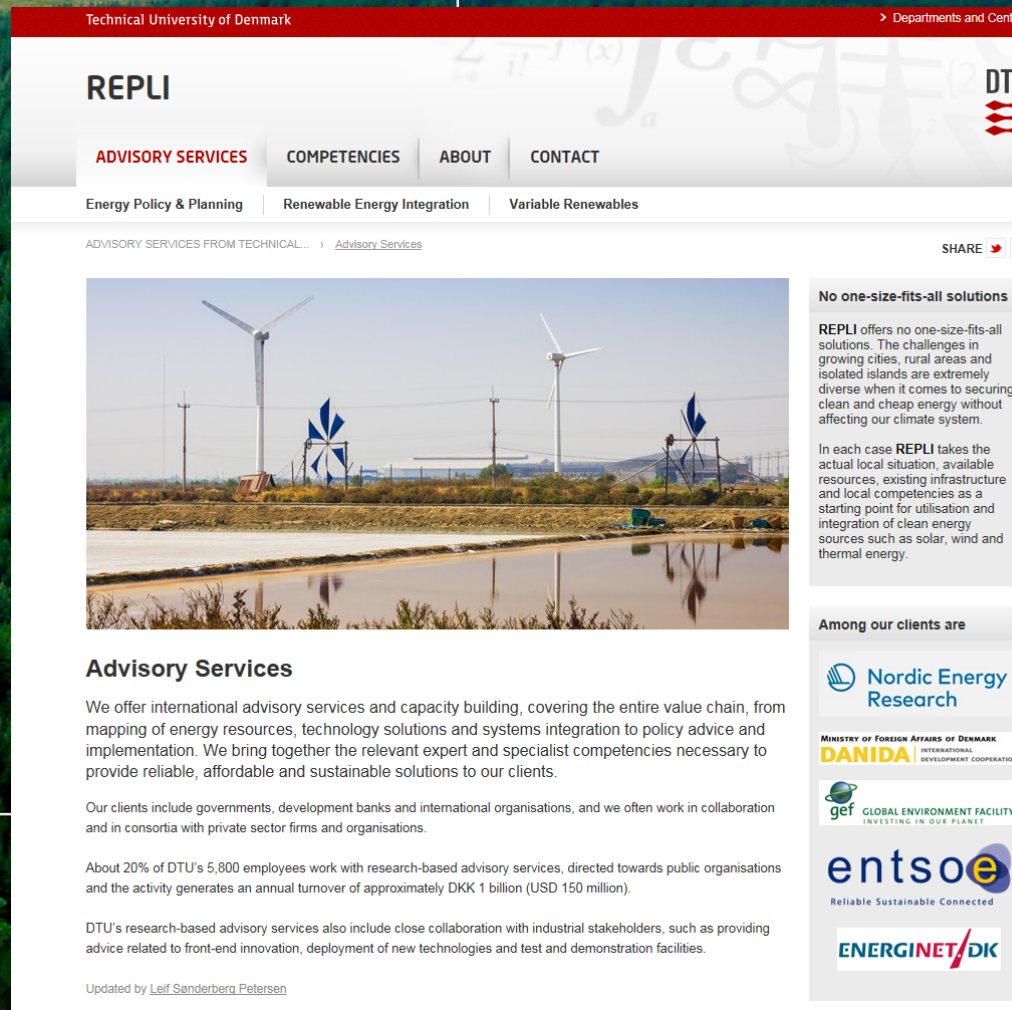
→

better technology and analysis methods within the energy sector.

Why advice on sustainable energy from DTU?

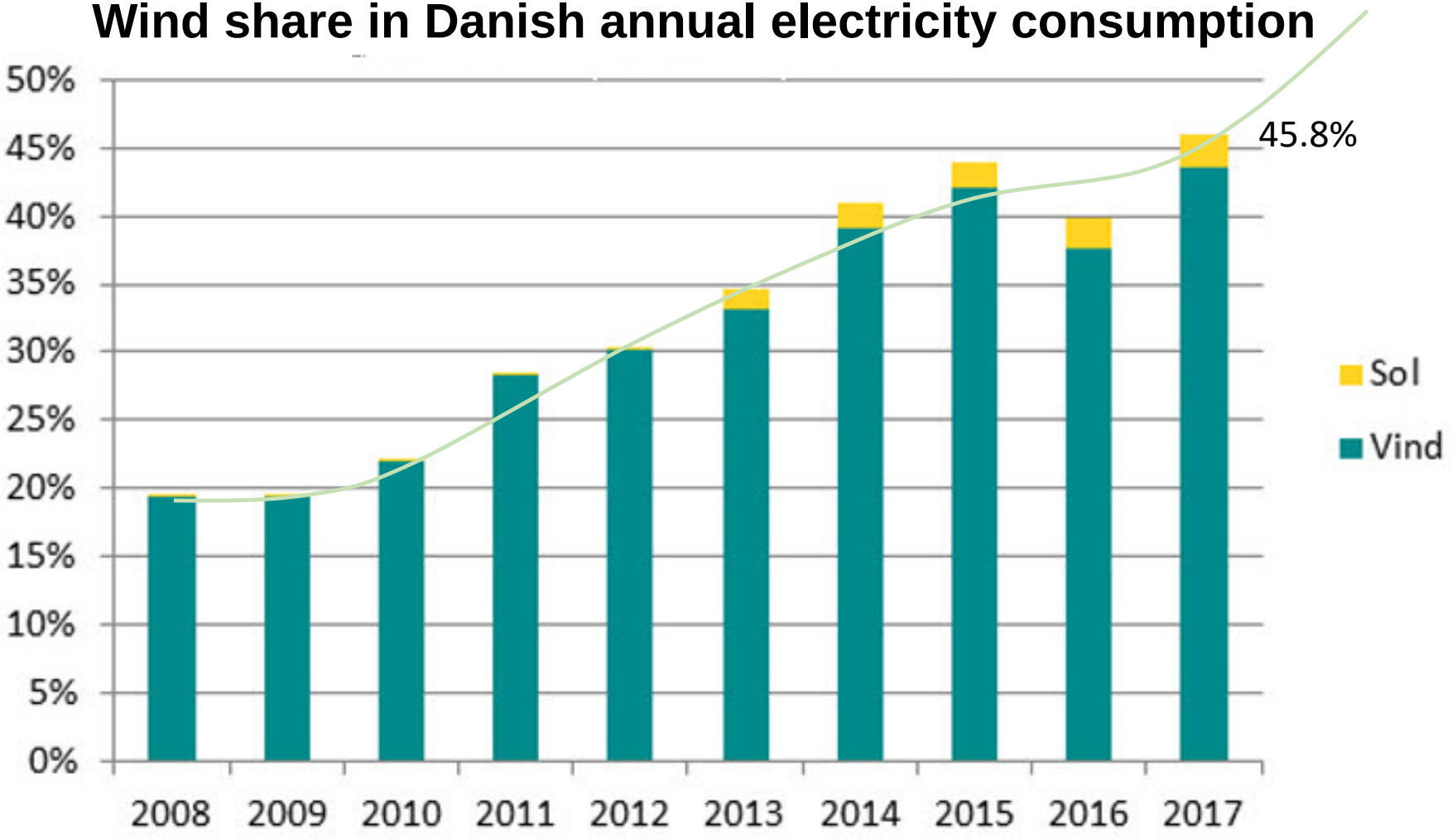
REPLI provides research based advisory services and capacity building within integration of intermittent renewable energy sources.

Our advisory services range from technology choices to policy advice and implementation.



The Kingdom of the Winds

Wind share in Danish annual electricity consumption



23 December 2017:
1 hour with 139%

25 December 2017:
1 day with average of 109%

Political target 2050:
The total energy supply based on renewable energy
incl. heat, gas, transport, industry, etc.

District heating:
50% share of total heat supply, with 69% CHP and <1% P2H

Flexibility Resources

Finding ramping capabilities

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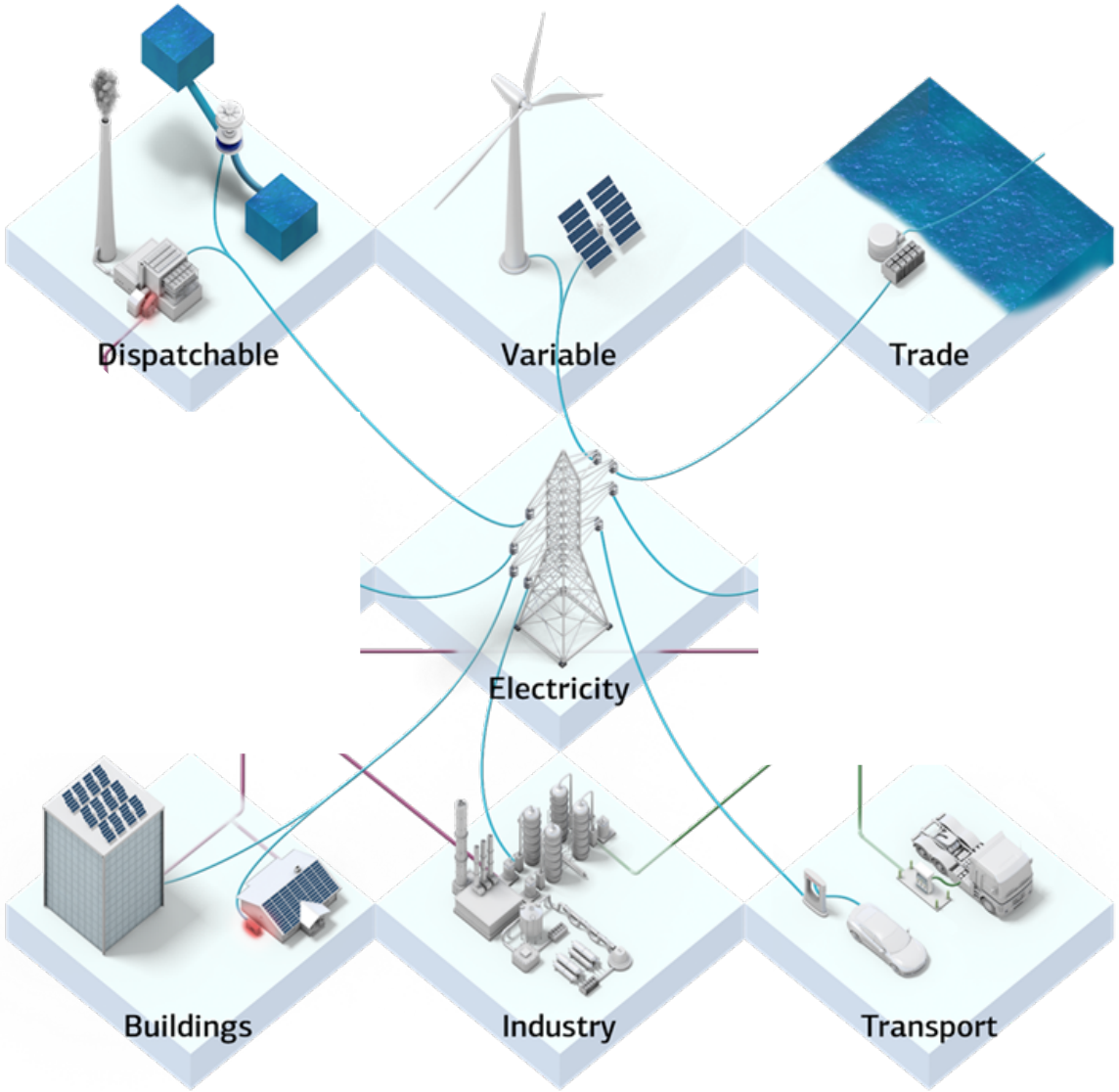
Resource

System

Service



Supply flexibility

Demand responds

Flexibility Resources

Finding ramping capabilities

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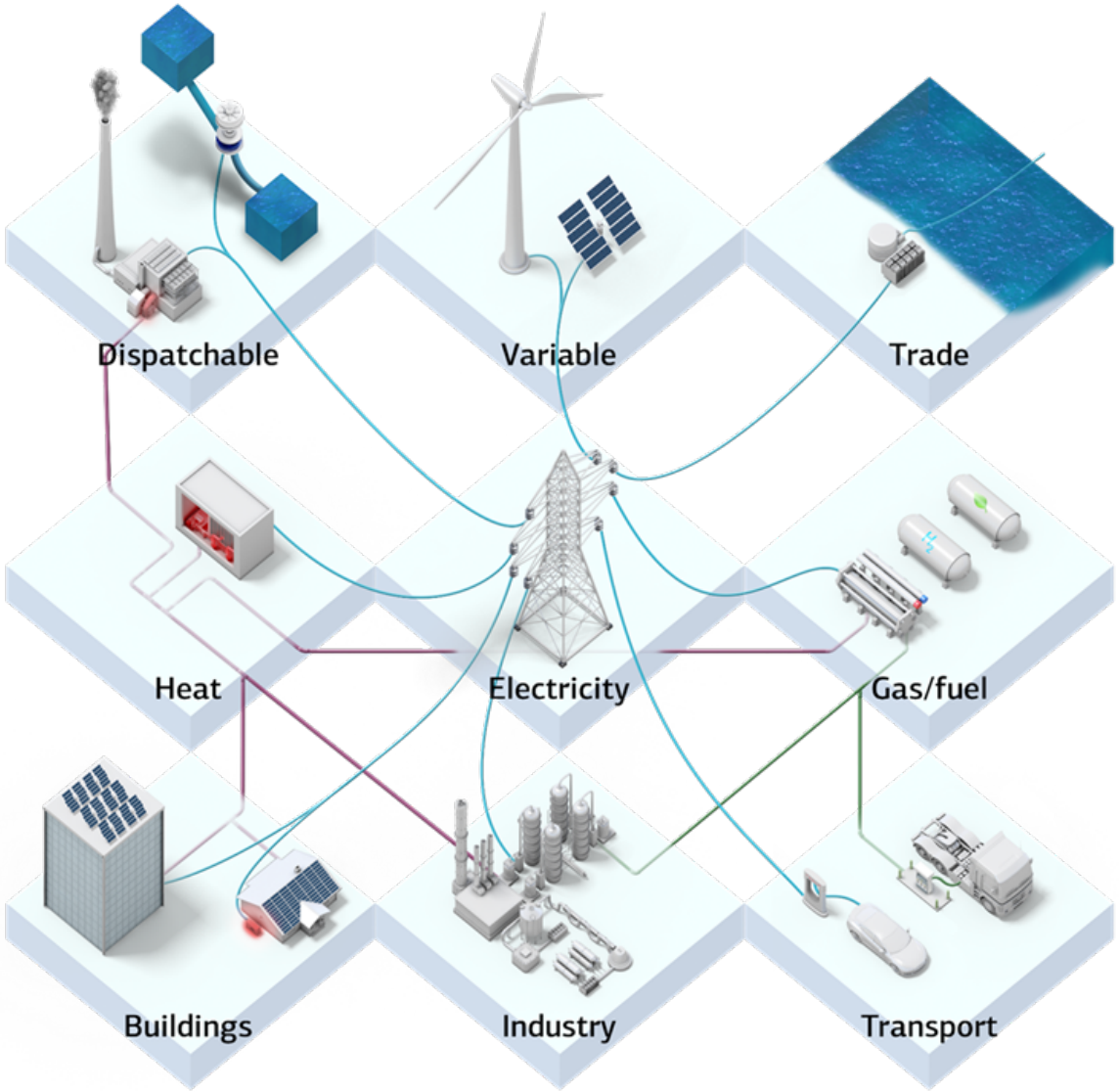
Resource

System

Service



Supply flexibility

Sector coupling/
Electrification

Demand responds

Sector coupling

Electrification as source of flexibility

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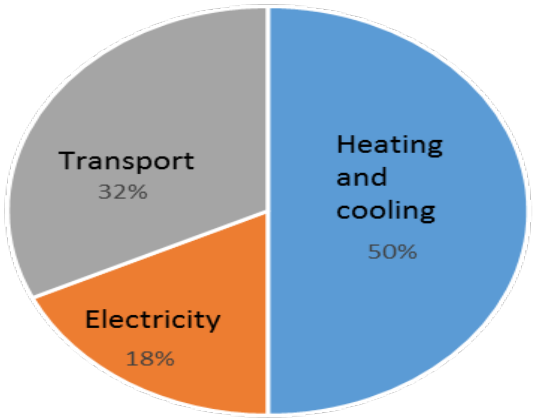
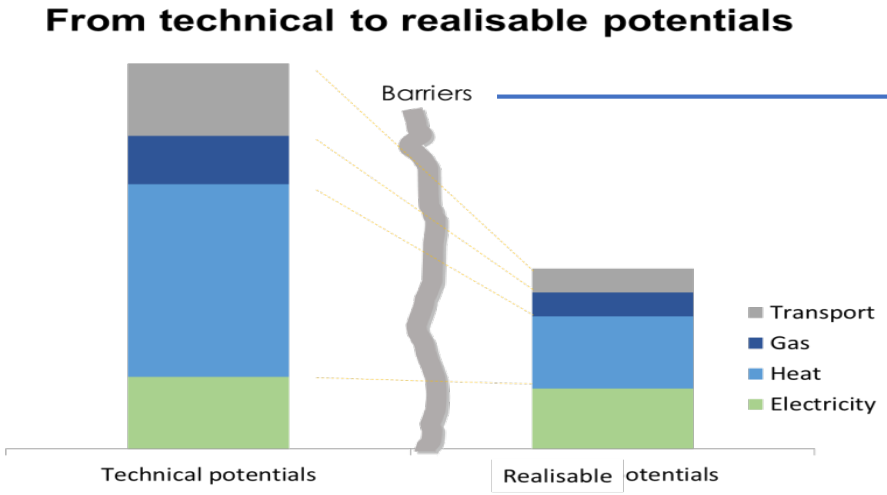


Distribution of EU energy consumption
(Source: EU Heating and Cooling strategy)



Framework conditions

- Market design
- Direct regulation
- Fiscal policies
- Support schemes
- Grid regulation

Large flexibility potentials in electrification of the energy sectors → Hindered by regulatory barriers → Remove barriers

Better Policies Accelerate Clean Energy Transition

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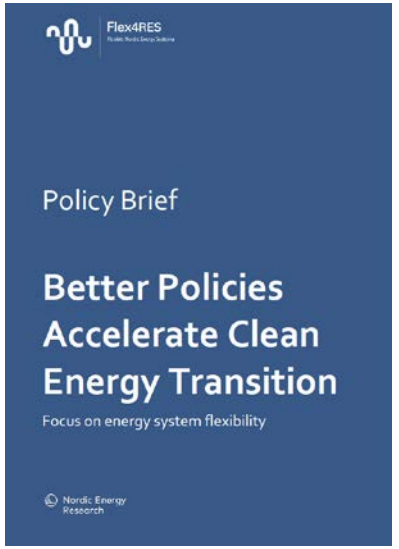
Insufficient market signals and uneven frameworks for different renewable energy resources limit flexibility

Revise tariffs, taxation, and subsidies in Nordic-Baltic countries to increase flexibility

Seven policy recommendations:

R1: Create a level playing field for all RES across sectors through consistent fiscal policies;
R2: Implement electricity grid tariffs which allow market signals for flexibility to reach the end-users;
R3: Dynamic taxation of electricity (e.g. restructuring levies and taxes);
R4: Encourage VRE operators to act flexibly using short-term market-based incentives;
R5: Abolish RES support during negative price periods;
R6: Enhance electrification by removing the limitations on using electricity for heating;
R7: Tackle investment risks in flexible individual heating through new financing and private ownership models.



Unlocking flexible and sustainable energy systems

Technical University of Denmark

Flex4RES
Flexible Nordic Energy Systems

Both technology deployment and regulatory changes

Coherent changes in market designs, regulatory framework condition, and coupling of markets

Make the sector coupling/electrification as flexible as possible

- Remove barriers
- Improve the business case for flexible power-to-heat/gas technologies
- Increase market integration and the value of VRE

www.Flex4RES.org

www.repli.dtu.dk

www.sys.man.dtu.dk